

REFERENCE: SF-790152

PROJECT: 17BP.9.R.67

| | | | |
|-------|-----------------------------|-----------|--------------|
| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
| N.C. | SF-790152 | 1 | 9 |

**STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT**

**STRUCTURE
SUBSURFACE INVESTIGATION**

COUNTY ROWAN
PROJECT DESCRIPTION REPLACE BRIDGE NO. 152
ON SR 2379 (ST. LUKES CHURCH ROAD)
OVER CHURCH CREEK

CONTENTS

| <u>SHEET NO.</u> | <u>DESCRIPTION</u> |
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| 1 | TITLE SHEET |
| 2, 2A | LEGEND (SOIL & ROCK) |
| 3 | SITE PLAN |
| 4-5 | CROSS SECTIONS |
| 6-9 | BORE LOGS |

PERSONNEL
J. K. STICKNEY

C. L. SMITH

INVESTIGATED BY K. B. MILLER
DRAWN BY W. D. FIELDS (TERRACON)
CHECKED BY K. B. MILLER
SUBMITTED BY K. B. MILLER
DATE APRIL 2017

CAUTION NOTICE

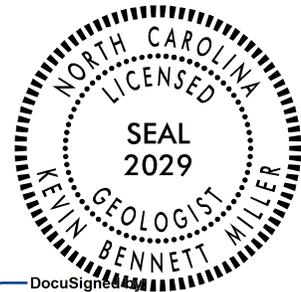
THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:

- THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
- BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.



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[Signature]
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4/20/2017

SIGNATURE

DATE

**DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 1 OF 2)

| SOIL DESCRIPTION | | | | | | | | | | GRADATION | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6 | | | | | | | | | | WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES. | | | | | | | | | |
| SOIL LEGEND AND AASHTO CLASSIFICATION | | | | | | | | | | ANGULARITY OF GRAINS | | | | | | | | | |
| GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS | | | | | | | | | | MINERALOGICAL COMPOSITION | | | | | | | | | |
| GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1-A-2, A-3, A-4, A-5, A-6, A-7 | | | | | | | | | | MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE. | | | | | | | | | |
| SYMBOL | | | | | | | | | | COMPRESSIBILITY | | | | | | | | | |
| % PASSING #10, #40, #200 | | | | | | | | | | SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50 | | | | | | | | | |
| MATERIAL PASSING #40 LL, PI | | | | | | | | | | PERCENTAGE OF MATERIAL | | | | | | | | | |
| GROUP INDEX | | | | | | | | | | ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL | | | | | | | | | |
| USUAL TYPES OF MAJOR MATERIALS | | | | | | | | | | TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE | | | | | | | | | |
| GEN. RATING AS SUBGRADE | | | | | | | | | | GROUND WATER | | | | | | | | | |
| EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE | | | | | | | | | | ▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING ▽ STATIC WATER LEVEL AFTER 24 HOURS ▽PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA ○ SPRING OR SEEP | | | | | | | | | |
| CONSISTENCY OR DENSENESS | | | | | | | | | | MISCELLANEOUS SYMBOLS | | | | | | | | | |
| PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²) | | | | | | | | | | ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION 25/825 DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT DMT VST PMT TEST BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CORE BORING MONITORING WELL INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY | | | | | | | | | |
| TEXTURE OR GRAIN SIZE | | | | | | | | | | RECOMMENDATION SYMBOLS | | | | | | | | | |
| U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053 | | | | | | | | | | UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK | | | | | | | | | |
| GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3 | | | | | | | | | | ABBREVIATIONS | | | | | | | | | |
| SOIL MOISTURE - CORRELATION OF TERMS | | | | | | | | | | AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY ? - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC 7/2 - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST SAMPLE ABBREVIATIONS DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC S - BULK e - VOID RATIO SD. - SAND, SANDY SD. - SAND, SANDY SS - SPLIT SPOON F - FINE SL. - SILT, SILTY SLI. - SLIGHTLY ST - SHELBY TUBE FOSS. - FOSSILIFEROUS TCR - TRICONE REFUSAL RS - ROCK FRAC. - FRACTURED, FRACTURES W - MOISTURE CONTENT RT - RECOMPACTED TRIAXIAL FRAGS. - FRAGMENTS HI. - HIGHLY V - VERY CBR - CALIFORNIA BEARING RATIO | | | | | | | | | |
| PLASTICITY | | | | | | | | | | EQUIPMENT USED ON SUBJECT PROJECT | | | | | | | | | |
| PLASTICITY INDEX (PI) DRY STRENGTH | | | | | | | | | | DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE: | | | | | | | | | |
| NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH | | | | | | | | | | <input type="checkbox"/> CME-45C <input type="checkbox"/> CLAY BITS <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL <input type="checkbox"/> CME-55 <input type="checkbox"/> 6' CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> CME-550X <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> PORTABLE HOIST <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE <input type="checkbox"/> STEEL TEETH <input type="checkbox"/> TRICONE <input type="checkbox"/> TUNG-CARB. <input type="checkbox"/> CORE BIT <input type="checkbox"/> CORE BIT | | | | | | | | | |
| COLOR | | | | | | | | | | CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -H <input type="checkbox"/> -N HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST | | | | | | | | | |
| DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE. | | | | | | | | | | | | | | | | | | | |

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SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

| | | |
|-------------------------------------|---|---|
| WEATHERED ROCK (WR) |  | NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED. |
| CRYSTALLINE ROCK (CR) |  | FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. |
| NON-CRYSTALLINE ROCK (NCR) |  | FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. |
| COASTAL PLAIN SEDIMENTARY ROCK (CP) |  | COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC. |

WEATHERING

| | |
|-------------------------------|---|
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. |
| VERY SLIGHT (V SL.) | ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE. |
| SLIGHT (SL.) | ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. |
| MODERATE (MOD.) | SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. |
| MODERATELY SEVERE (MOD. SEV.) | ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i> |
| SEVERE (SEV.) | ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</i> |
| VERY SEVERE (V SEV.) | ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</i> |
| COMPLETE | ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE. |

ROCK HARDNESS

| | |
|-----------------|---|
| VERY HARD | CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. |
| HARD | CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. |
| MODERATELY HARD | CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. |
| MEDIUM HARD | CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. |
| SOFT | CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. |
| VERY SOFT | CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL. |

FRACTURE SPACING

| TERM | SPACING |
|------------------|---------------------|
| VERY WIDE | MORE THAN 10 FEET |
| WIDE | 3 TO 10 FEET |
| MODERATELY CLOSE | 1 TO 3 FEET |
| CLOSE | 0.16 TO 1 FOOT |
| VERY CLOSE | LESS THAN 0.16 FEET |

BEDDING

| TERM | THICKNESS |
|---------------------|-------------------|
| VERY THICKLY BEDDED | 4 FEET |
| THICKLY BEDDED | 1.5 - 4 FEET |
| THINLY BEDDED | 0.16 - 1.5 FEET |
| VERY THINLY BEDDED | 0.03 - 0.16 FEET |
| THICKLY LAMINATED | 0.008 - 0.03 FEET |
| THINLY LAMINATED | < 0.008 FEET |

INDURATION

| | |
|---|---|
| FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. | |
| FRIABLE | RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. |
| MODERATELY INDURATED | GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. |
| INDURATED | GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. |
| EXTREMELY INDURATED | SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS. |

TERMS AND DEFINITIONS

| |
|--|
| ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. |
| AQUIFER - A WATER BEARING FORMATION OR STRATA. |
| ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. |
| ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. |
| ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. |
| CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. |
| COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. |
| CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. |
| DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. |
| DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. |
| DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. |
| FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. |
| FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. |
| FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. |
| FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. |
| FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. |
| JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. |
| LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. |
| LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. |
| MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. |
| PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. |
| RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. |
| ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. |
| SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. |
| SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. |
| SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. |
| STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS IN OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. |
| STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. |
| STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. |
| TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. |

BENCH MARK: BL-2 STAMPED 79-0152-2

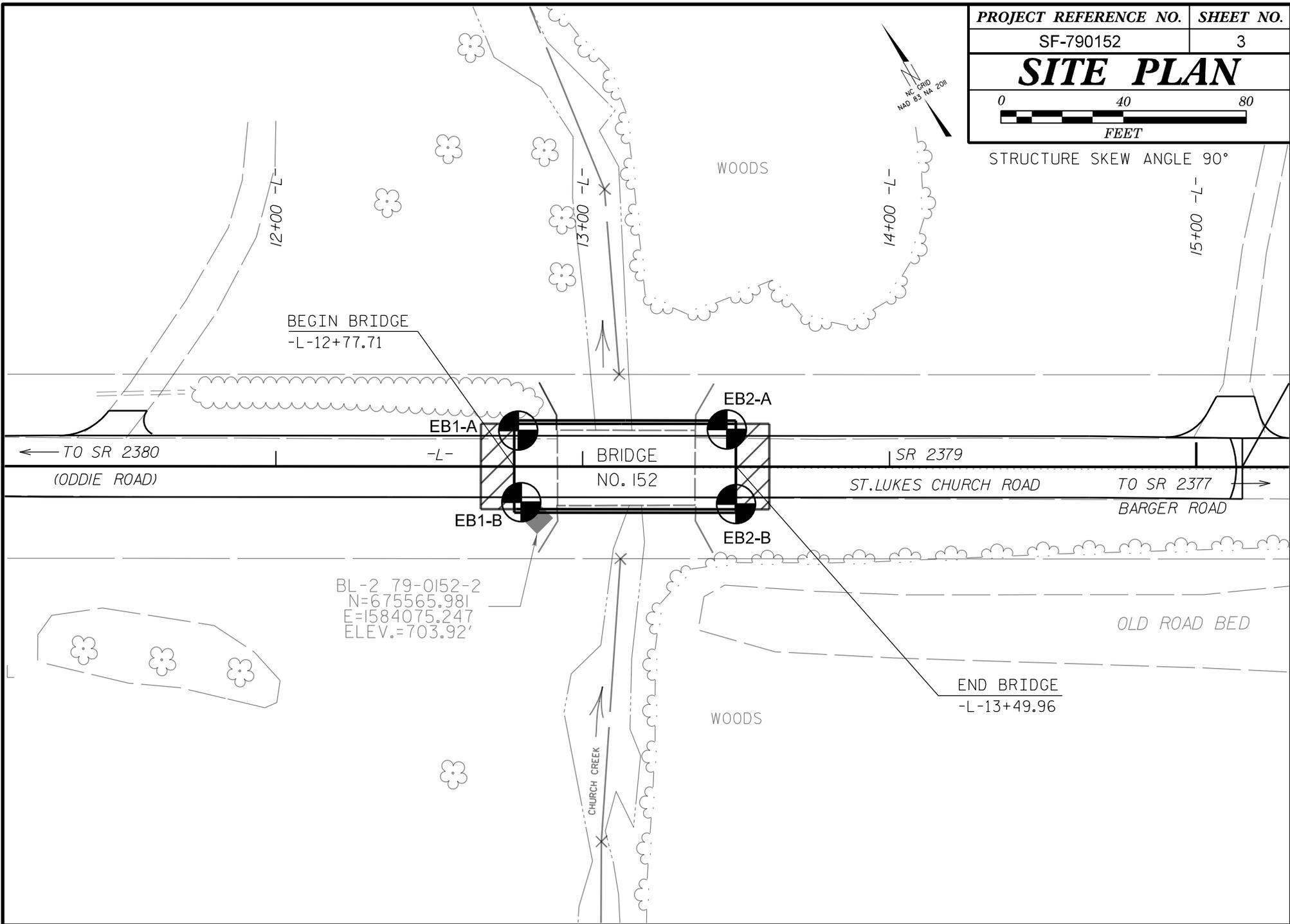
N:675565,9810; E:1584075,2470 STA. I2+85.12 -EL- 16.75 FEET RIGHT
ELEVATION: 703.92 FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

| | |
|------------------------------|------------------|
| PROJECT REFERENCE NO. | SHEET NO. |
| SF-790152 | 3 |
| SITE PLAN | |
| | |
| FEET | |

STRUCTURE SKEW ANGLE 90°



BEGIN BRIDGE
-L-12+77.71

← TO SR 2380
(ODDIE ROAD)

EB1-A

-L-

BRIDGE
NO. 152

SR 2379

ST. LUKES CHURCH ROAD

TO SR 2377
BARGER ROAD →

EB1-B

EB2-B

BL-2 79-0152-2
N=675565.981
E=1584075.247
ELEV.=703.92'

OLD ROAD BED

END BRIDGE
-L-13+49.96

WOODS

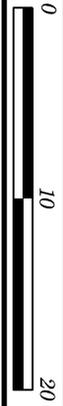
CHURCH CREEK

WOODS

NC GRID
NAD 83 NA 2011

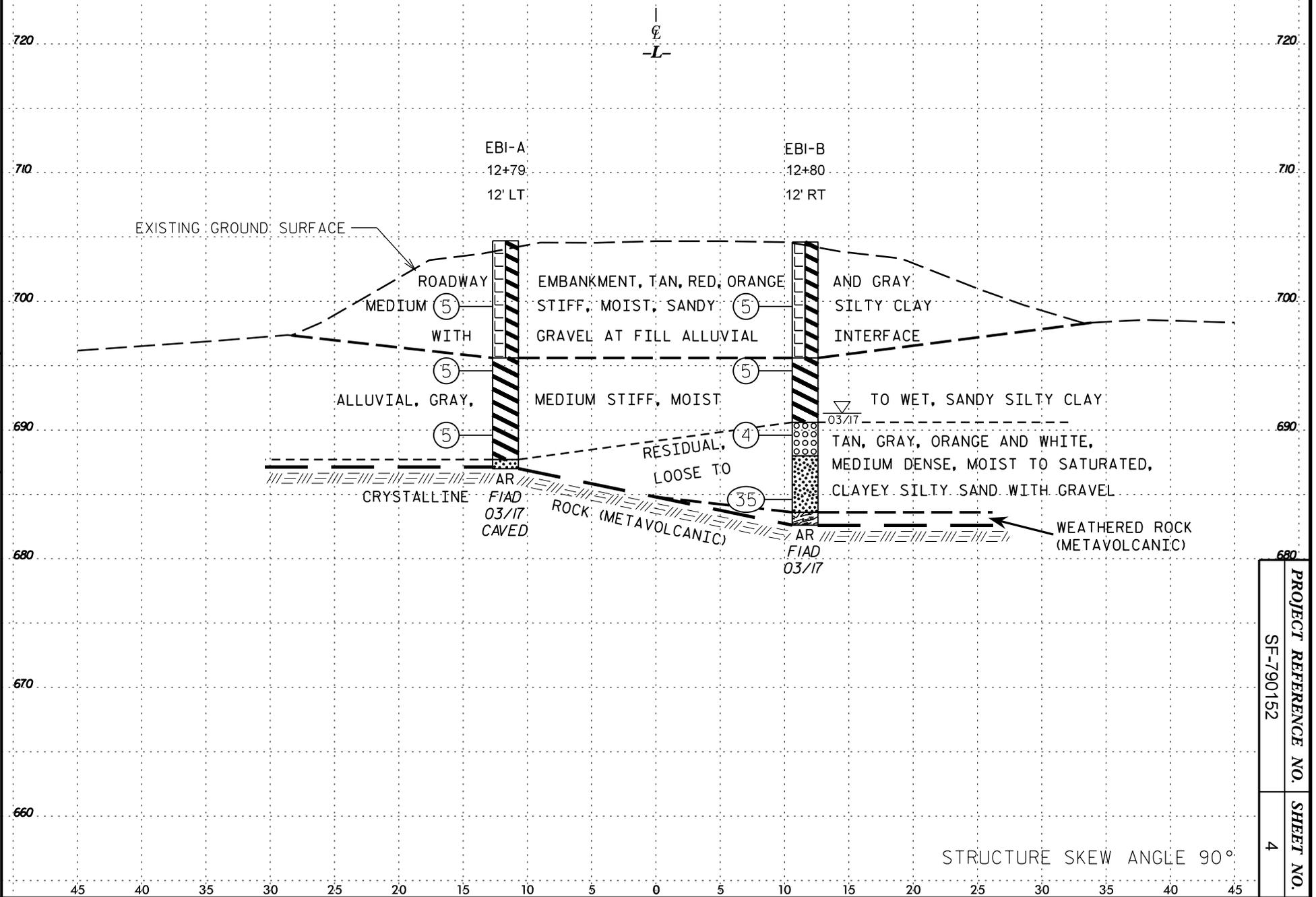
CROSS SECTION THROUGH END BENT 1 AT STA. 12+77.71 -L-

HORIZ. SCALE 0 (FEET)



VE = 1:1

CROSS SECTION THROUGH END BENT 1 AT STA. 12+77.71 -L-

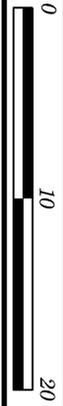


| | |
|-----------------------|-----------|
| PROJECT REFERENCE NO. | SF-790152 |
| SHEET NO. | 4 |

CROSS SECTION THROUGH END BENT 2 AT STA. 13+49.96 -L-

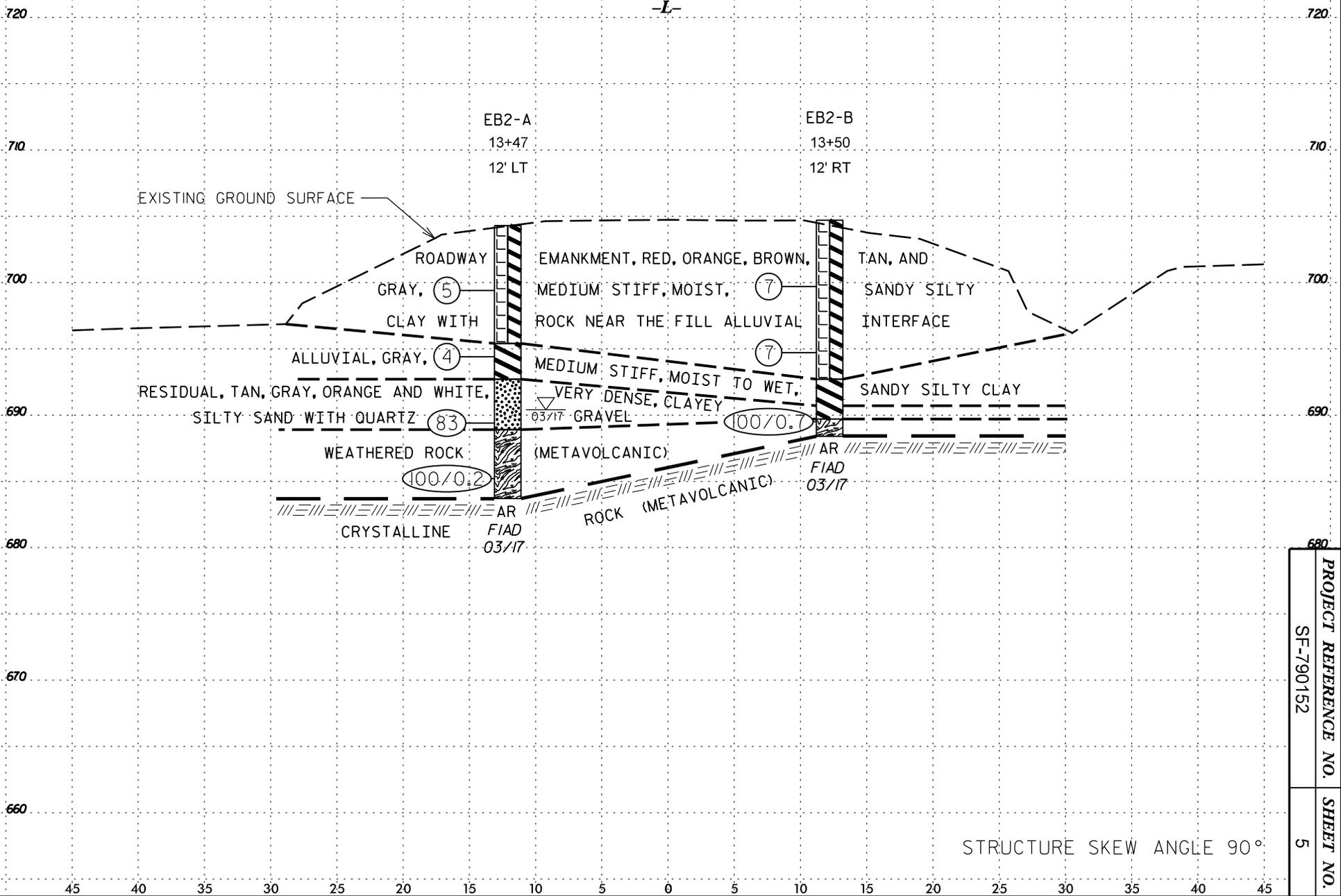


HORIZ. SCALE 0 (FEET)



VE = 1:1

CROSS SECTION THROUGH END BENT 2 AT STA. 13+49.96 -L-



STRUCTURE SKEW ANGLE 90°

| | |
|-----------------------|-----------|
| PROJECT REFERENCE NO. | SHEET NO. |
| SF-790152 | 5 |

GEOTECHNICAL BORING REPORT

BORE LOG

| WBS 17BP.9.R.67 | | | TIP SF-790152 | | | COUNTY ROWAN | | | GEOLOGIST Stickney, J. K. | | | | | | | | |
|---|-----------------|------------|----------------------------|-------|-------|---------------------------------|----|----|----------------------------------|-----|-----------|-----|-----|---------------------------|------------|---|------|
| SITE DESCRIPTION BRIDGE NO. 152 ON SR 2379 (ST. LUKES CHURCH ROAD) OVER CHURCH CREEK | | | | | | | | | GROUND WTR (ft) | | | | | | | | |
| BORING NO. EB1-A | | | STATION 12+79 | | | OFFSET 12 ft LT | | | ALIGNMENT -L- | | | | | | | | |
| COLLAR ELEV. 704.7 ft | | | TOTAL DEPTH 17.7 ft | | | NORTHING 675,594 | | | EASTING 1,584,084 | | | | | | | | |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 84% 05/15/2015 | | | | | | DRILL METHOD H.S. Augers | | | HAMMER TYPE Automatic | | | | | | | | |
| DRILLER Smith, C. L. | | | START DATE 03/15/17 | | | COMP. DATE 03/15/17 | | | SURFACE WATER DEPTH N/A | | | | | | | | |
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) | | |
| | | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | | | ELEV. (ft) | |
| 705 | | | | | | | | | | | | | | | 704.7 | GROUND SURFACE | 0.0 |
| 700 | 700.6 | 4.1 | | | | | | | | | | | | | | ROADWAY EMBANKMENT TAN, ORANGE, GRAY AND BLACK, SANDY SILTY CLAY | |
| 695 | 695.6 | 9.1 | 2 | 2 | 3 | | | | | | | | | | | | |
| 690 | 690.6 | 14.1 | 1 | 2 | 3 | | | | | | | | | | 695.6 | ALLUVIAL GRAY, SANDY SILTY CLAY | 9.1 |
| | | | 1 | 3 | 2 | | | | | | | | | | 687.7 | | 17.0 |
| | | | | | | | | | | | | | | | 687.0 | TAN AND ORANGE, VERY DENSE, CLAYEY SILTY SAND | 17.7 |
| | | | | | | | | | | | | | | | | Boring Terminated BY AUGER REFUSAL at Elevation 687.0 ft ON CRYSTALLINE ROCK (METAVOLCANIC) | |
| | | | | | | | | | | | | | | | | CAVED @ 11 FEET AFTER DRILLING | |

NCDOT BORE SINGLE SF790152_GEO.GPJ NC_DOT.GDT 4/5/17

GEOTECHNICAL BORING REPORT

BORE LOG

| WBS 17BP.9.R.67 | | | TIP SF-790152 | | | COUNTY ROWAN | | | GEOLOGIST Stickney, J. K. | | | | | | | |
|--|-----------------|------------|---------------------|-------|-------|--------------------------|----|----|---------------------------|-----|-----------|---------|---|------------|----------------|-----|
| SITE DESCRIPTION BRIDGE NO. 152 ON SR 2379 (ST. LUKES CHURCH ROAD) OVER CHURCH CREEK | | | | | | | | | GROUND WTR (ft) | | | | | | | |
| BORING NO. EB1-B | | | STATION 12+80 | | | OFFSET 12 ft RT | | | ALIGNMENT -L- | | | | | | | |
| COLLAR ELEV. 704.6 ft | | | TOTAL DEPTH 22.0 ft | | | NORTHING 675,573 | | | EASTING 1,584,073 | | | | | | | |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 84% 05/15/2015 | | | | | | DRILL METHOD H.S. Augers | | | HAMMER TYPE Automatic | | | | | | | |
| DRILLER Smith, C. L. | | | START DATE 03/15/17 | | | COMP. DATE 03/15/17 | | | SURFACE WATER DEPTH N/A | | | | | | | |
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG MOI | SOIL AND ROCK DESCRIPTION | DEPTH (ft) | | |
| | | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | | | |
| 705 | | | | | | | | | | | | | | 704.6 | GROUND SURFACE | 0.0 |
| 700 | 700.6 | 4.0 | 1 | 2 | 3 | 5 | | | | | | M | ROADWAY EMBANKMENT RED, ORANGE AND GRAY, SANDY SILTY CLAY | | | |
| 695 | 695.6 | 9.0 | 2 | 2 | 3 | 5 | | | | | | M/W | GRAVEL IN FILL FROM 8 - 9 FEET | 9.0 | | |
| 690 | 690.6 | 14.0 | 1 | 2 | 2 | | | | | | | Sat. | ALLUVIAL GRAY, SANDY SILTY CLAY | | | |
| 685 | 685.6 | 19.0 | 19 | 15 | 20 | 35 | | | | | | M/W | GRAY, CLAYEY SILTY SAND WITH GRAVEL | 14.0 | | |
| | | | | | | | | | | | | | RESIDUAL TAN, GRAY, ORANGE AND WHITE, CLAYEY SILTY SAND | 16.6 | | |
| | | | | | | | | | | | | | WEATHERED ROCK (METAVOLCANIC) | 21.0 | | |
| | | | | | | | | | | | | | Boring Terminated BY AUGER REFUSAL at Elevation 682.6 ft ON CRYSTALLINE ROCK (METAVOLCANIC) | 22.0 | | |

NCDOT BORE SINGLE SF790152_GEO.GPJ NC_DOT.GDT 4/5/17

GEOTECHNICAL BORING REPORT

BORE LOG

| WBS 17BP.9.R.67 | | | TIP SF-790152 | | | COUNTY ROWAN | | | GEOLOGIST Stickney, J. K. | | | | | | | |
|--|-----------------|------------|---------------------|-------|-------|--------------------------|----|----|---------------------------|-----|-----------|---------|---------------------------|---|---|-------|
| SITE DESCRIPTION BRIDGE NO. 152 ON SR 2379 (ST. LUKES CHURCH ROAD) OVER CHURCH CREEK | | | | | | | | | GROUND WTR (ft) | | | | | | | |
| BORING NO. EB2-A | | | STATION 13+47 | | | OFFSET 12 ft LT | | | ALIGNMENT -L- | | | | | | | |
| COLLAR ELEV. 704.3 ft | | | TOTAL DEPTH 20.6 ft | | | NORTHING 675,560 | | | EASTING 1,584,143 | | | | | | | |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 84% 05/15/2015 | | | | | | DRILL METHOD H.S. Augers | | | HAMMER TYPE Automatic | | | | | | | |
| DRILLER Smith, C. L. | | | START DATE 03/15/17 | | | COMP. DATE 03/15/17 | | | SURFACE WATER DEPTH N/A | | | | | | | |
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG MOI | SOIL AND ROCK DESCRIPTION | DEPTH (ft) | | |
| | | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | | | |
| 705 | | | | | | | | | | | | | | 704.3 | GROUND SURFACE | 0.0 |
| 700 | 700.4 | 3.9 | 2 | 2 | 3 | | | | | | | | M | ROADWAY EMBANKMENT RED, ORANGE, TAN AND GRAY, SILTY CLAY | | |
| 695 | 695.4 | 8.9 | 2 | 2 | 2 | | | | | | | | M/W | ROCK IN FILL FROM 8 - 9 FEET | 8.9 | |
| 690 | 690.4 | 13.9 | 7 | 10 | 73 | | | | | | | | D | ALLUVIAL GRAY, SANDY SILTY CLAY | 11.6 | |
| 685 | 685.4 | 18.9 | | | | | | | | | | | | RESIDUAL TAN, GRAY, ORANGE AND WHITE, CLAYEY SILTY SAND WITH QUARTZ GRAVEL | 15.4 | |
| | | | | | | | | | | | | | | WEATHERED ROCK (METAVOLCANIC) | | |
| | | | | | | | | | | | | | | | | 683.7 |
| | | | | | | | | | | | | | | | Boring Terminated BY AUGER REFUSAL at Elevation 683.7 ft ON CRYSTALLINE ROCK (METAVOLCANIC) | |

NCDOT BORE SINGLE SF790152_GEO.GPJ NC_DOT.GDT 4/5/17

GEOTECHNICAL BORING REPORT

BORE LOG

| WBS 17BP.9.R.67 | | | TIP SF-790152 | | | COUNTY ROWAN | | | GEOLOGIST Stickney, J. K. | | | | | | | |
|--|-----------------|------------|---------------------|-------|--------|--------------------------|----|----|---------------------------|-----|-----------|---------|---------------------------|---|---|------|
| SITE DESCRIPTION BRIDGE NO. 152 ON SR 2379 (ST. LUKES CHURCH ROAD) OVER CHURCH CREEK | | | | | | | | | GROUND WTR (ft) | | | | | | | |
| BORING NO. EB2-B | | | STATION 13+50 | | | OFFSET 12 ft RT | | | ALIGNMENT -L- | | | | | | | |
| COLLAR ELEV. 704.7 ft | | | TOTAL DEPTH 16.3 ft | | | NORTHING 675,538 | | | EASTING 1,584,134 | | | | | | | |
| DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 84% 05/15/2015 | | | | | | DRILL METHOD H.S. Augers | | | HAMMER TYPE Automatic | | | | | | | |
| DRILLER Smith, C. L. | | | START DATE 03/15/17 | | | COMP. DATE 03/17/17 | | | SURFACE WATER DEPTH N/A | | | | | | | |
| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG MOI | SOIL AND ROCK DESCRIPTION | DEPTH (ft) | | |
| | | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | | | |
| 705 | | | | | | | | | | | | | | 704.7 | GROUND SURFACE | 0.0 |
| 700 | 700.7 | 4.0 | 2 | 3 | 4 | | | | | | | | M | ROADWAY EMBANKMENT RED, BROWN AND GRAY, SANDY SILTY CLAY | | |
| 695 | 695.7 | 9.0 | 2 | 4 | 3 | | | | | | | | M | | | |
| 690 | 690.7 | 14.0 | 7 | 30 | 70/0.2 | | | | | | | | M/W | ROCK IN FILL 11 - 12 FEET ALLUVIAL GRAY, SANDY SILTY CLAY | 12.0 | |
| | | | | | | | | | | | | | | 689.7 | | 15.0 |
| | | | | | | | | | | | | | | 688.4 | WEATHERED ROCK (METAVOLCANIC) | 16.3 |
| | | | | | | | | | | | | | | | Boring Terminated BY AUGER REFUSAL at Elevation 688.4 ft ON CRYSTALLINE ROCK (METAVOLCANIC) | |

NCDOT BORE SINGLE SF790152_GEO.GPJ NC_DOT.GDT 4/5/17